

What is claimed is:

1. A modified antibody comprising two or more H chain V regions and two or more L chain V regions of monoclonal antibody and showing an agonist action by crosslinking a cell surface molecule(s).

2. The modified antibody of claim 1, wherein H chain V region and L chain V region are connected through a linker.

3. The modified antibody of claim 1 or 2, wherein the linker comprises at least one amino acid.

4. The modified antibody of any one of claims 1 to 3, wherein the modified monoclonal antibody is a dimer of single chain Fv comprising an H chain V region and an L chain V region.

5. The modified antibody of any one of claims 1 to 3, wherein the modified antibody is a single chain polypeptide comprising two H chain V regions and two L chain V regions.

6. The modified antibody of any one of claims 1 to 5, wherein the modified antibody further comprises an amino acid sequence(s) for peptide purification.

7. The modified antibody of any one of claims 1 to 6, wherein the modified antibody has been purified.

8. The modified antibody of any one of claims 1 to 7, wherein H chain V region and/or L chain V region is humanized H chain V region and/or L chain V region.

9. The modified antibody of any one of claims 1 to 8,

wherein the cell surface molecule is a hormone receptor or a cytokine receptor.

10.       The modified antibody of claim 9, wherein the cell surface molecule is selected from the group consisting of

5 erythropoietin (EPO) receptor, thrombopoietin (TPO) receptor, granulocyte colony stimulating factor (G-CSF) receptor, macrophage colony stimulating factor (M-CSF) receptor, granular macrophage colony stimulating factor (GM-CSF) receptor, tumor necrosis factor (TNF) receptor,

10 interleukin-1 (IL-1) receptor, interleukin-2 (IL-2) receptor, interleukin-3 (IL-3) receptor, interleukin-4 (IL-4) receptor, interleukin-5 (IL-5) receptor, interleukin-6 (IL-6) receptor, interleukin-7 (IL-7) receptor, interleukin-

15 9 (IL-9) receptor, interleukin-10 (IL-10) receptor, interleukin-11 (IL-11) receptor, interleukin-12 (IL-12) receptor, interleukin-13 (IL-13) receptor, interleukin-15 (IL-15) receptor, interferon-alpha (IFN-alpha) receptor, interferon-beta (IFN-beta) receptor, interferon-gamma (IFN-gamma) receptor, growth hormone (GH) receptor, insulin

20 receptor, blood stem cell proliferation factor (SCF) receptor, vascular epidermal growth factor (VEGF) receptor, epidermal cell growth factor (EGF) receptor, nerve growth factor (NGF) receptor, fibroblast growth factor (FGF) receptor, platelet-derived growth factor (PDGF) receptor,

25 transforming growth factor-beta (TGF-beta) receptor, leukocyte migration inhibitory factor (LIF) receptor, ciliary neurotrophic factor (CNTF) receptor, oncostatin M

(OSM) receptor and Notch family receptor.

11. The modified antibody of any one of claims 1 to 10, wherein the agonist action is induction of apoptosis, induction of cell proliferation and induction of cell differentiation.

12. The monoclonal antibody of any one of claims 1 to 11, wherein the L chain V region and the H chain V region are from the same monoclonal antibody.

13. The monoclonal antibody of any one of claims 1 to 12 which shows an improved agonist action compared with the original monoclonal antibody.

14. A DNA which encodes the modified antibody of any one of claims 1 to 13.

15. An animal cell which produces the modified antibody of any one of claims 1 to 13.

16. A microorganism which produces the modified antibody of any one of claims 1 to 13.

17. Use of the modified antibody of any one of claims 1 to 13 as an agonist.

18. A method of producing a dimer of single chain Fv which comprises culturing host animal cells producing the single chain Fv in serum-free medium to have the single chain Fv secreted into the medium and purifying a dimer of the single chain Fv produced in the medium.

19. A method of stabilizing a dimer of single chain Fv which comprises culturing host animal cells producing single chain Fv in serum-free medium to have the single chain Fv

secreted into the medium and to form a dimer of the single chain Fv.

20. A method of inducing agonist action to cells which comprises administering the first ligand and the second  
5 ligand binding to a cell surface molecule(s) and administering a substance which binds to the first and the second ligands and crosslinks the first and the second ligands.

21. The method of claim 20 wherein the first and the  
10 second ligands are the same or different single chain Fv monomer.

22. The method of claim 20 or 21 wherein the substance which crosslinks the ligands is an antibody, an antibody fragment or a bivalent modified antibody.

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